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AUTHOR Robinson, Nancy M.; Magliocca, Larry A.
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ABSTRACT

The paper examines an expert systems methodology for identifying and modeling the problem-situated expertise of the regular class teacher, with the objective of determining how regular class teachers who demonstate consistent success or expertise mediate instructional problems. The study, with six identified expert primary-level teachers, analyzed 12 case studies using an heuristic classification model. Although the teachers did not apply the same sets of strategies, they did apply similar classes of strategies, including viewing the classroom as a social system and using reciprocal interactions to teach various roles and responsibilities. Among major findings was that the expert teachers shared the expectation that every student entering their classroom would learn. The teachers elicited student responses to guide students further and made effective learning strategies explicit to their students. Ten solution classes were identified, including building the learner's sense of competence, increasing the student's motivation to learn, and increasing active participation. The expert training systems methodology was seen to provide a preliminary training materials prototype appropriate for use with regular educators. Includes 45 references. (DB)

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Identifying and Modeling the Problem Situated Expertise of the Regular Class Teacher in the Instruction of At-Risk and Mildly Handicapped Students

Nancy M. Robinson, Ph.D.
Project Director

Larry A. Magliocca, Ph.D.
Associate Director

Center for Special Needs Populations
Ackerman Place, Suite 440
400 Ackerman Road
Columbus, OH 43202

American Educational Research Association
Annual Conference 1991
Chicago, Illinois

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Identifying and Modeling the Problem-Situated Expertise of the Regular Class Teacher in the Instruction of At-Risk and Mildly Handicapped Students

There is an increased demand for instructional approaches that effectively meet the needs of mildly handicapped and at-risk students in regular classroom settings (Bender & Ukeje, 1989; Keogh, 1988; Wang et. al., 1986). A traditional source for identification of such instructional approaches has been derived from the content and methodologies developed within special education contexts (Johnson, Pugach & Hammitte, 1988). However, there is a growing interest in deriving a better understanding of the knowledge base which regular class teachers apply to the problems encountered by the mildly handicapped and at-risk students (Bender & Ukeje, 1989; Reisberg & Wolf, 1988). The problem-situated expertise of the regular class teacher merged with that of special education can only serve to enhance the instruction received by mainstreamed students. This article will focus on implementing an experimental methodology for identifying and modeling the problem-situated expertise of the regular class teacher in serving the mildly handicapped and at-risk student. In particular, how do regular class teachers who demonstrate consistent success or expertise in this setting mediate instructional problems.

Regular and Special Education: Contextual Settings

The relationship between special education and regular education is currently in the process of exploring new parameters (Hallahan, Kauffman, Lloyd & McKinney, 1988; Will, 1986). A major impetus for change emerged from the Regular Education Initiative (Will, 1986), which reflected a growing disatisfaction with the content and structural components of service delivery options for mainstreamed handicapped students (Stainback, Stainback, Courtnage & Jaben, 1985; Reynolds, Wang & Walberg, 1987). The traditional relationship between special and regular education has been based on the delivery of services across a full range of varying contexts from resource room based pull-out programs to self-contained classrooms (Semmel, Gottlieb & Robinson, 1979). Consequently, the expertise in providing instructional support for mildly handicapped and at-risk students has developed within situational contexts removed from the mainstream of regular education.

The regular education initiative (Will, 1986) proposed a shifting of the traditional parameters in the delivery of special education services from direct contact with special education teachers in settings outside the mainstream to delivery of services within the mainsteamed setting. Consequently, both special and regular educators are collaborating to explore conceptual and methodological avenues that may lead to more effective instructional approaches in mainstreamed classroom settings. The model emerging as the bridge between special and regular education is collaborative consultation (Idol, Paolucci-Whitcomb & Nevin, 1986; Friend, 1988; West & Brown, 1987). Although this model proposes some promising directions for serving children in mainstreamed settings, a number of pragmatic and conceptual barriers remain to be addressed (Johnson, Pugach & Hammitte, 1988). In particular, a fundamental issue is the source of expertise. One approach emphasizes that collaborative consultation should be based on a reciprocal arrangement that draws upon the diverse expertise of educational professionals in problem solving (Idol et al., 1986). However, analysis of consultation models and practice reveal a hierarchical relationship, with the flow of information moving from the consultant to the classroom teacher (Graden et al., 1985; Johnson, Pugach & Hammitte, 1988; Pugach & Johnson, 1989). The risk of the hierarchical models, is that they limit the recognition of the classroom

teacher's expertise. To facilitate successful collaborations, special educators must recognize the classroom teacher as a valuable source of instructional knowledge.

At a more fundamental level of problem solving is the issue of knowledge derived from situational contexts. The contextual settings in which instruction occurs have evolved differently for regular and special education. Traditionally, students having learning difficulties, who could not maintain a minimal level of success in a regular classroom context, were placed in alternative settings in order to remediate the problems. Specialized programs and materials were designed to provide students with needed skills which would aid their integration back into the mainstreamed classroom setting. However, the different situational contexts for serving children have also generated different methodologies for solving problems. Special educators have preferred behavioral data-based interventions, direct instruction and related curriculum-based assessments (Idol et al., 1986; Pugach & Whitten, 1987). Consultants have observed a resistance on the part of regular classroom teachers to embrace suggested methodologies within the context of their classrooms (Keogh, 1988; Wang et al., 1986; Rosenfield, 1985).

In redefining the collaborative parameters between special and regular education, the knowledge base for instructional expertise will need elaboration and expansion. A valuable source of information is the expert regular education teacher who has developed a successful experiential base for integrating the needs of all children into the mainstream. Expert knowledge generated from this context combined with the resources of special education should be a first step in facilitating a more successful collaboration in meeting the challenge of the Regular Education Initiative. Accompanying this challenge, has been a call for innovation in methodology used by researchers in exploring ways to better serve students in the mainstream (Kauffman, 1987; Poplin, 1987). The study reported in this article represents a blending of methodologies used to investigate the problem situated expertise of the regular class teacher.

Problem Situated Expertise

Recent developments in the study of experts and problem situated expertise provide a frame of reference for initiating this investigation. The study of experts in different fields indicate there are similarities in how problems are identified and solved (Berliner, 1986; Leinhardt & Greeno, 1986; Housner & Griffey, 1985; Lave, 1988). Prominent among this growing body of research is the view that it may be more productive to study knowledge-in-action rather than identify knowledge structures or schemata alone (Clancy, 1982; Lampert & Clark, 1990; Perkins & Salomon, 1989). This has resulted in a shift in thinking about how an expert approaches problems and generates solutions. Traditionally, a good problem solver was characterized as successfully applying a general problem solving strategy or a class of heuristics to any particular database of knowledge, with the database operating as an incidental necessity (Perkins & Salomon, 1989).

Classic experiments of expertise indicate that general heuristics may not be the most powerful influence on problem-solving, rather, tactics selected appear to be drawn from rich databases of knowledge. For example, expert chess players do not appear to rely on a few specific rules from which they reason about options and consequences. Rather, it appears that their choice of tactics involve a rich knowledge base of chess pieces and their standard patterns, but also upon experientially gained chunk-like configurations allowing them to think ahead and devise more complex strategies for problem-solving (Chase & Simon, 1973; Perkins & Salomon, 1989; Rabinowitz & Glaser, 1985; Schonenfeld & Herrmann, 1982). Based on these studies expert performance could be characterized by (1) A rich

experiential data base of domain specific patterns (2) rapid recognition of situations where these patterns apply and (3) a series of reasoning moves from the rapid recognition of specific patterns towards a solution by working with these patterns.

This view of expertise in problem-solving aligns itself naturally with a situated view of cognition. That is, "all knowledge is a joint construction of mind and the situation in which the mind finds itself confronted with a problem" (Lampert & Clark, 1990: 22). The expert teacher has built up a knowledge base of experience over time within within the social and physical context of the classroom. This knowledge base may be more a representation of experience from "doing" rather than just "knowing" about problems and their solutions. Therefore, the study of propositional knowledge alone may not effectively convey how expert teachers dynamically problem solve and interact with students within the social boundaries of the regular classroom setting. Recognizing that a difference has existed between the study of domain-specific propositional knowledge and the knowledge of practice, there is a need to investigate how an expert teacher integrates this knowledge into action.

A productive methodological approach, protocols of actual performance, have been generated from the study of problem situated expertise (Barnett & Cwirko-Godycki, 1988; Clancy, 1982; Schon, 1983). In the study of specific cases, Schon (1983) demonstrated that by beginning with protocols of of actual performance, it is possible to construct and test models of knowing as they occur in situational contexts. This finding has been supported by Berliner (1986) whose investigation of expert teacher's protocols indicated that they approached student problems in terms of classes of behaviors and and classes of events rather than characterizing each student individually. This observation supports the view of expert performance as characterized by solutions generated from a rapid recognition of specific patterns of problems (Chase & Simon, 1973; Schoenfeld & Herrmann, 1982; Glaser, 1984, Rabinowitz & Glaser, 1985). However, in order to identify and model this knowledge for use by special and regular educators, the method of study within the protocol is critical in determining how this knowledge will be framed and communicated. Therefore, the study presented in this article will draw upon the methodology of an expert systems models for investigating protocols of problem situated expertise: McFarland and Parker's (1990) expert systems development model.

Modeling Problem-Situated Expertise

The McFarland and Parker (1990) model evolved from expert systems technology for the purposes of developing a knowledge base for computer programming and human training purposes. It was relevant to the problem under investigation because it provides an overall structure in identifying and modeling knowledge while at the same time considers the requirements of communication for training purposes.

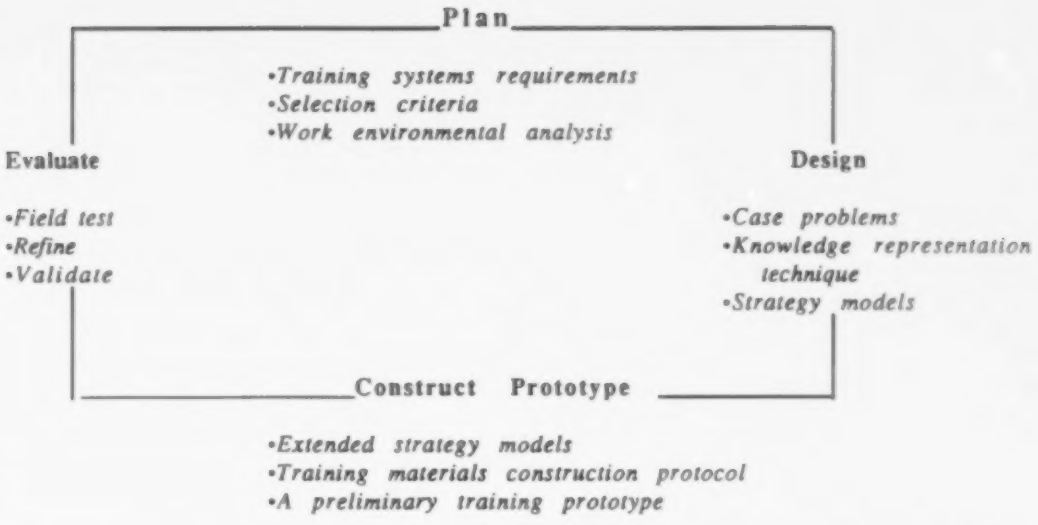

Figure 1. Expert Systems Development Process (McFarland & Parker, 1990)

In initiating the study, a plan must articulate the *training systems requirements*. In somewhat general terms initially, there is a need to identify what conditions and experiences will meet the future trainees' needs. With the understanding of the training system requirements in mind, *selection criteria* for identifying appropriate working environments and experts that will yield the conditions of expert performance. *Work environmental analysis* provides the scope and detail of expert performance within the context of everyday practice. The events and interactions of the expert are observed, recorded and categorized as skills, repertoires and strategies of expert performance.

The design encompasses *case problems* which are selected in conjunction with the expert that exemplify both the routine and novel problems of daily practice. The expert performance observed and analyzed within the working environment provide the explicit and accessible knowledge of the expert. A *knowledge representation technique* is selected that appropriately captures the expert's heuristic reasoning and behavioral processes. *Strategy models* are constructed and "debugged" in conjunction with expert performers.

A prototype is constructed where *extended strategy models* are developed to include supportive skills and repertoires necessary to achieve proficiency at the strategy level. A *training materials construction protocol* is applied in developing the instructional materials to facilitate an efficient interaction and experience for trainees (Silber & Stelnicki, 1987). Then a *preliminary training prototype* is now drafted to meld the extended strategy model and the trainees' instructional needs. Finally an evaluation must include field testing of the training prototype in order to refine and validate the system. Evaluation data is collected and analyzed to determine if the training system requirement is met.

Method

Sample

The identification of regular educators was guided by the expert systems development model. The selection criteria included recommendations by peers, school principals and superintendents of regular class teachers who demonstrated consistent success with academic and social integration of mildly handicapped and at-risk children. Initial referrals were were observed and interviewed and claims of academic and social success were evaluated in terms of school records. Academic progress of students, both curriculum based and results of normative testing were considered along with referral rates and the characteristics of students in their classrooms.

A total of six teachers two in each grade level (K-3) were selected for the study. In terms of work environmental analysis, school settings which demonstrated a balance between minority and non-minority students and lower and middle socioeconomic status were selected. Each teacher had to have three or more mildly handicapped or at-risk students in their classrooms for at least 75% of the day. All teachers held bachelor's degrees with four of the six holding master's degrees. The teachers averaged 10 years in the regular elementary classroom. All teachers were female.

Procedures

Observations

Observations provided the first data source of the work environment analysis. Running records of teacher-student interactions were made with no defined observational system. The purpose was to describe the naturalistic setting of the classroom along with the nature and type of teacher-student interactions taking place within a lesson. Two observers simultaneously observed and recorded events. The events and interactions of the expert are observed, recorded and categorized as skills, repertoires and strategies of expert performance. The simultaneous, but independent records were compared and contrasted for analysis. A total of 30 hours of observation were recorded by each researcher. The average was 10 hours per teacher. All observations took place towards the end of the school year so that teachers had a full year to establish their classroom environments.

Case Studies

Each teacher was asked to prepare an in-depth case study of two children with mild handicaps or risk factors that interfered with school progress. Case problems that exemplified both the routine and novel problems of daily practice were selected in conjunction with the expert teacher. They were asked to include descriptions of (1) student backgrounds, (2) their own observations about why the student was identified as at-risk or mildly handicapped, (3) how and why they organized their instructional program the way they did to include these students, (4) their reflections on student progress and (5) provide reflections on their own teaching.

Interviews

The case study framed the starting point for the in-depth interviews. Each interview was strategically planned to access teacher reflection about (1) how they view specific problems within the classroom and (2) how they approached instruction within a heterogeneous classroom. A particular emphasis was focused through probes in relation to

how problems were identified along with how a solution was generated. All interviews were tape-recorded and transcribed for analysis. All verbal problems were worded in the past tense to emphasize the interest in knowing how the expert actually solved the problem. Probes were open-ended and included elaborative requests such as "tell us more about how you.....". An ethnographic method was used in which the expert's words were restated as questions to elicit more detailed elaborations without biasing the expert's thoughts (Meyer, Mniszewski & Peaslee, 1989).

Data Analysis

In order to analyze the classes of problem behaviors and classes of solutions identified by the teachers, a heuristic classification system was implemented (Clancy, 1985). This system provided a knowledge representation technique for organizing the protocol data. It was used as a method of computation in capturing problem situations that tend to occur with solutions that tend to work. This methodology derived from expert systems analysis captures knowledge not as static descriptions, but as efficient useful connections for problem solving. A heuristic association then is a connection that relates problem classes to problem solutions.

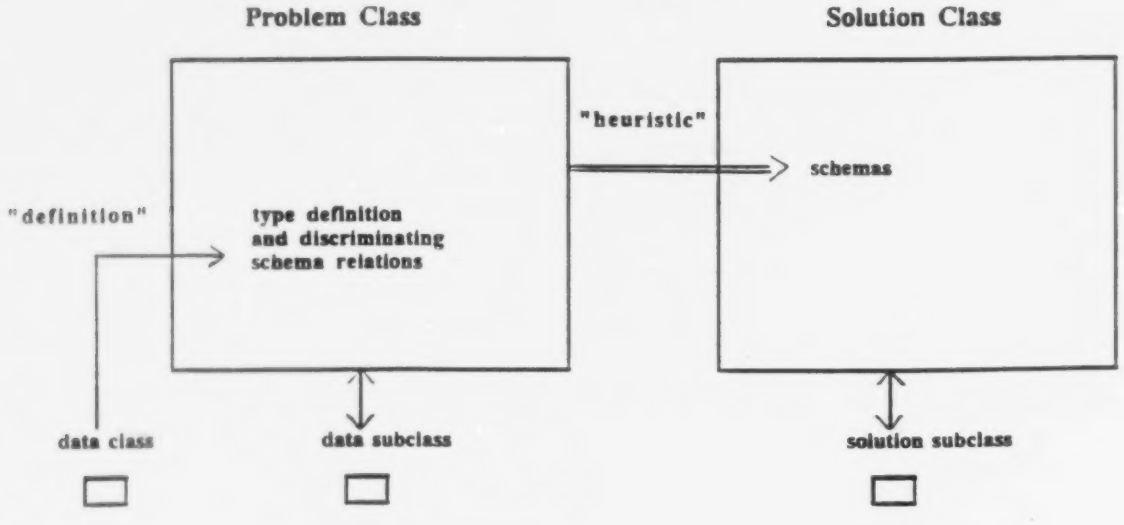

Figure 2. Heuristic classification system (Clancy, 1985)

Case studies were framed by this model. Propositional statements defined problem classes and solutions. The objective of the analysis was not to identify propositional statements as the source of experiential knowledge, rather to provide a frame for seeking information in relation to (1) how problems where identified, (2) if problems were identified by patterns and (3) how solutions were generated for these problems within their situational contexts. It provided a method for decomposing problems by mapping data abstractions onto a fixed hierarchical network of solutions. Each case was mapped by this model. Teachers were then asked to respond to the classification data. This step provided an opportunity for teachers to clarify and "debug" how they identified and related solutions to problems. The

interview data combined with the observations provided a description of the working environment or situational context in which the problem case was encountered.

Results

Separate analyses of each case study were conducted within the context of the heuristic model. There were a total of twelve cases. Figure 3 represents a typical case.

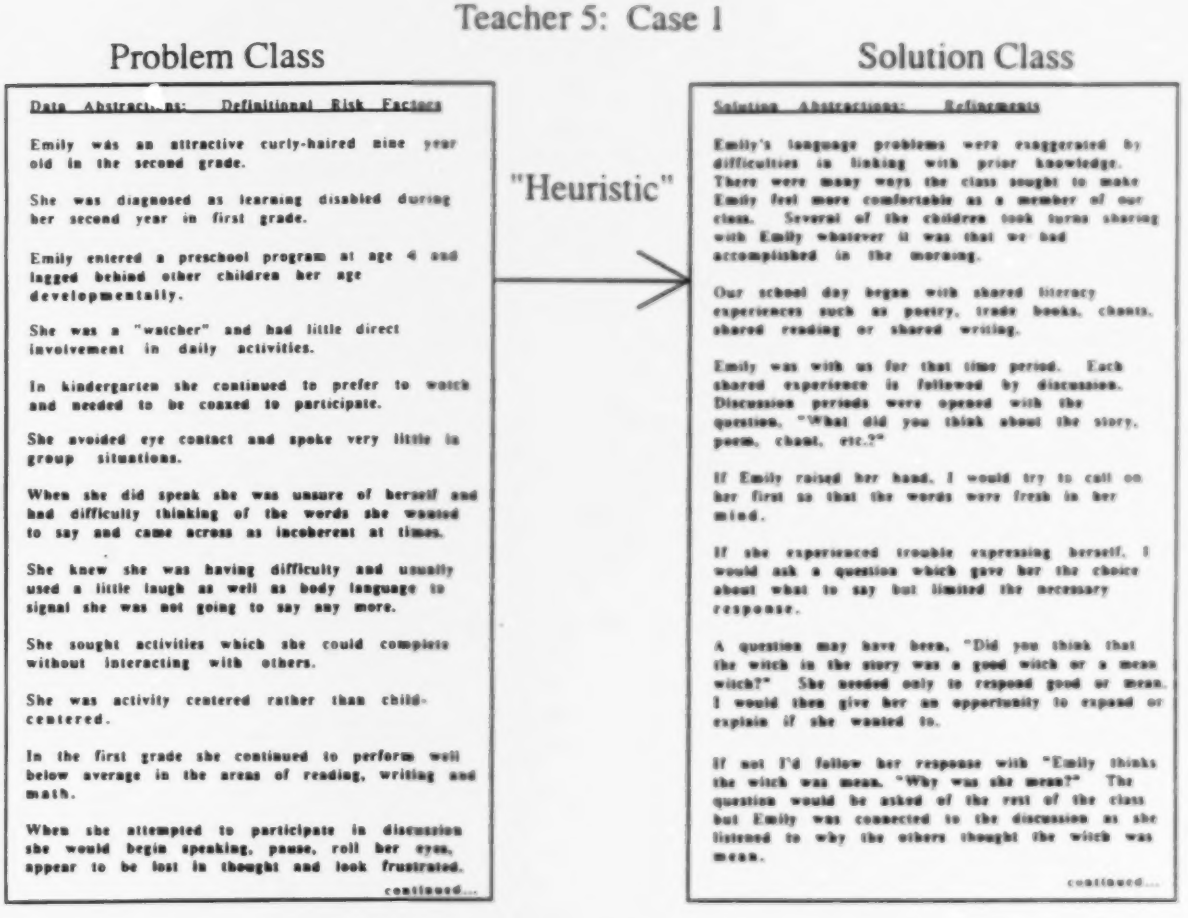
Teacher 5: Case 1
Problem Class
Data Abstractions: Definitional Risk Factors
Emily was an attractive curly-haired nine year old in the second grade.
She was diagnosed as learning disabled during her second year in first grade.
Emily entered a preschool program at age 4 and lagged behind other children her age developmentally.
She was a "watcher" and had little direct involvement in daily activities.
In kindergarten she continued to prefer to watch and needed to be coaxed to participate.
She avoided eye contact and spoke very little in group situations.
When she did speak she was unsure of herself and had difficulty thinking of the words she wanted to say and came across as incoherent at times.
She knew she was having difficulty and usually used a little laugh as well as body language to signal she was not going to say any more.
She sought activities which she could complete without interacting with others.
She was activity centered rather than child-centered.
In the first grade she continued to perform well below average in the areas of reading, writing and math.
When she attempted to participate in discussion she would begin speaking, pause, roll her eyes, appear to be lost in thought and look frustrated.
continued...
"Heuristic"
Solution Class
Solution Abstractions: Refinements
Emily's language problems were exaggerated by difficulties in linking with prior knowledge. There were many ways the class sought to make Emily feel more comfortable as a member of our class. Several of the children took turns sharing with Emily whatever it was that we had accomplished in the morning.
Our school day began with shared literacy experiences such as poetry, trade books, chants, shared reading or shared writing.
Emily was with us for that time period. Each shared experience is followed by discussion. Discussion periods were opened with the question, "What did you think about the story, poem, chant, etc.?"
If Emily raised her hand, I would try to call on her first so that the words were fresh in her mind.
If she experienced trouble expressing herself, I would ask a question which gave her the choice about what to say but limited the necessary response.
A question may have been, "Did you think that the witch in the story was a good witch or a mean witch?" She needed only to respond good or mean. I would then give her an opportunity to expand or explain if she wanted to.
If not I'd follow her response with "Emily thinks the witch was mean. "Why was she mean?" The question would be asked of the rest of the class but Emily was connected to the discussion as she listened to why the others thought the witch was mean.
continued...

Figure 3. Sample data framed by heuristic classification model

Problem Classes

The problem classes and problem solutions identified by the case studies and in-depth interviews were synthesized with the observation records. The results of the analyses indicated a number of patterns which observed to occur across teachers: (1) academically related problems, (2) social-emotionally related problems, (3) home status problems, (4) motivational problems and (5) socioeconomic factors. It was clear that may of the problems

were overlapping in terms of classes. For example, an academically related problem was viewed by the teacher as overlapping with motivational and home status problems. Although the teachers agreed to the general class subtypes, they did not view them as discrete entities. Rather, they viewed risk factors and problems as overlapping and flexible, subject to constant change.

The case studies generated profiles of students which appeared to "trigger" hypotheses about sets of problem-solving strategies that could be applied to the situation. For example, the teachers would often give metaphoric labels to characterize the different profiles such as "street wise" or "watcher" or "early bloomer". The teachers often "chunked" the risk factors into patterns or profiles which characterized a child's difficulties. For example, Teacher 5: Case 1, it was stated that "she was a watcher" and had little direct involvement in daily activities. In kindergarten, she continued to prefer to watch and needed to be coaxed to participate." The metaphor "watcher" represented an integration of classes of risk factors. It is clear that while not all information processed by the teacher could be captured in the case studies, the labeling of patterns appeared to generate sets of hypotheses about strategies that could be implemented in their contextual settings.

Solution Classes

The solution classes were more difficult to classify into data subsets. The teachers identified sets of strategies, repertoires and skills for addressing sets of risk factors. Basically, problem sets "triggered" solution sets. The solution sets were grouped into classes in relation to the function served. Teachers refined the classes during the in-depth interview. There was general agreement that they could be grouped heuristically into the following solution subclasses:

1. Building a learner's sense of competence
2. Increasing the student's motivation to learn
3. Increasing active participation
4. Linking student prior knowledge to new learning
5. Building successful dialogue through strategic questioning
6. Encouraging risk taking in learning
7. Maintaining a strong home school connection
8. Integrating students into the classroom social system
9. Encouraging independence in thinking and problem-solving
10. Developing a sense of shared participation in lesson meaning and purpose

In reviewing the observations, case studies and in-depth interviews, one characteristic was related to all solution refinements: the belief that "all students entering my class will learn and are expected to learn." Repeatedly, these teachers referred to this belief as a major influence in the selection of strategies and tactics and how they communicated with students. Both investigators observed that it was as if every interaction, verbal and nonverbal was framed by this strongly held belief. It was interesting to observe how each of these teachers felt it was their responsibility not to simply "transmit" knowledge to the students by "telling" them what they needed to know, rather, they see learning as a process of collaboration.

Each of the teachers interviewed indicated the importance of curriculum goals and objectives in planning lesson content. However, they viewed instruction in terms of "how to strategically access this new knowledge to each student's existing knowledge."

Therefore, instruction in these classrooms could be characterized as negotiating meaning that makes sense to the student. The teachers recognized that student's brings different aptitudes and experiences to each learning task. Their job as they see it, is to guide the learner to construct meaning based on what they already know through strategies that allow them to make sense of new ideas. In practice, a wide variety of thinking and problem solving skills were made explicit and modeled by the teachers.

Based on verbal reports and the classroom observations, the teachers appeared to make consistent efforts to emphasize that differences in student knowledge should be respected. Interactions such as questioning reflected this belief. For example, if a child had difficulty responding to a question, the teacher would seek ways for the child to partially respond and receive positive recognition for trying. The teachers strategically engineered classroom discussions to emphasize that "it was okay to have different degrees of experience with different ideas and concepts. Accordingly, as we learn about new ideas, it is okay to make mistakes. Mistakes are to be respected and are viewed as opportunities to learn." These teachers would probe students to elaborate upon their ideas so not just substantive content could be shared, but also the thinking processes used to arrive at those answers. There was a clear emphasis not just on product, but the process of thinking and learning. For example, rather than explaining a task to the students, and then having them complete it, the expert teacher engaged the students in a reciprocal dialogue about potential strategies and procedures that could be used.

Six of the eight teachers explicitly shared the intention of increasing student active participation through increasing dialogue about processes used rather than the product alone. They expressed the belief that by increasing student involvement in this way, it tended to facilitate greater independence in thinking and problem solving over time. Also by encouraging independence, students often demonstrated a greater sense of ownership in lesson activities as reflected by increased motivation and interest. Observations of the teachers reflected this intention. The first impression upon entering their classrooms was that they were not dominated by teacher talk. There appeared to be a strategic effort on the part of the teacher to negotiate meaning through highly interactive dialogue. The role of the teacher appeared to be one of guiding the interactive process, with the emphasis placed on student responding. The classroom interactions reflected the teacher stated intentions that active participation by all was the norm.

All teachers in this study appeared to be particularly adept at guiding students to elaborate upon their responses and take risks. This was evident in questioning repertoires and skills. Teachers would ask the mildly handicapped and at-risk students questions they could have success with early on. However, as familiarity with content and question types increased over time, the teacher would push the student to answer more difficult questions. The dialogue that took place during interactions reflected a sensitivity to the student's sense of competence. Rather than using negative statements about student progress ie. "You should have known that!" , these teachers could be characterized as guiding all interactions to build up a sense of "You Can" do it, let's look at ways you solve this problem. They guided students through a style of interaction to complete a task to some degree on his or her own, while at the same time building a sense of competence. All of the teachers indicated that they purposefully organized opportunities for regular parental involvement to build home-school connections.

Another major class of solutions was observed to be related to building a sense of shared purpose. As one teacher stated, " We are here to learn together and work together". There was a consensus among the teachers that the process of building a sense of shared purpose promoted socialization through interacting about "why" specific content is important and "why" specific classroom routines facilitate group and individual accomplishments.

Observations indicated that these teachers initiated positive interactions about these issues frequently as a means of maintaining the group focus. During interviews the teachers indicated that establishing a strong shared sense of purpose generally increased motivation and interest and tended to reduce off-task behaviors. They felt that the mildly handicapped and at-risk student strongly benefited from these interactions, for they along with all classroom members demonstrated a strong sense of group membership. The teachers created opportunities for peer involvement through cooperative learning experiences. Group procedures for problem solving were made explicit. The teachers provided frequent feedback to groups and how they engaged in problem solving behaviors. Strengths and strategy solutions to problems were identified and used as models to be shared with the entire classroom. There was consensus among the teachers both in the solution classes identified and through the interviews that the process of building a shared sense of purpose promoted socialization and provided positive models for children of different ability levels. By building a sense of classroom culture in this way, the teachers agreed that all students demonstrated a willingness to take risks in responding and problem solving in the group setting.

A preliminary training prototype

The information generated from the data was integrated into a strategy model. The model integrated the supportive skills and repertoires of the expert teachers in a form that could be communicated to other teachers (Magliocca & Robinson, 1991). The common thread running across all dimensions of the solution classes was the belief that "every student who enters my classroom will learn." The belief that "I Can" rather than "I Can't" was a primary characteristic of the strategies and repertoires identified. The teacher was viewed as a mediator in the "I Can" prototype. A mediative style of interaction characterized all dialogue within the classroom for it formed the bridge by which all strategies and repertoires were linked. For example, the teacher as mediator comes between a student's current understanding of a concept or idea and selects a particular strategy to guide that student's progress along a continuum of understanding. This represents Phase 1 of the preliminary training prototype.

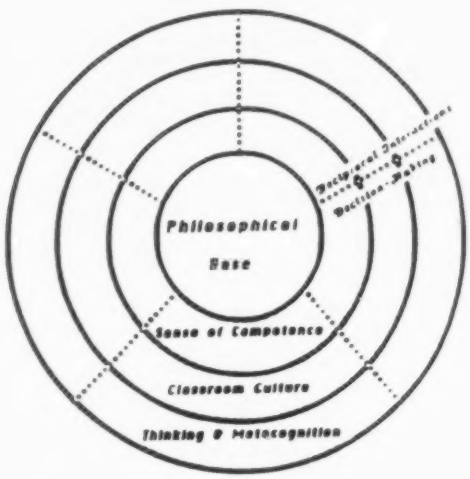

Figure 4. "I Can" strategy model

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Teacher beliefs were the unifying core which influenced the selection of strategies and the nature of the teacher-student interactions. All reciprocal interactions become framed by these beliefs. The reciprocal interactions become the vehicle for strategically guiding the students to be part of the classroom culture, to build a sense of competence and to develop thinking and problem solving skills. Phase 2, involved the development of a training package (Silber & Stelnicki (1987). Special attention was given to what is communicated and how it is communicated in terms of both regular and special education teachers. The prototype represented the expert strategies in problem situated contexts, where the instructional group is engaged in a problem solving process about risk factors and potential strategy solutions.

Field Test: Evaluate

The final component of the McFarland and Parker(1990) model is field testing and evaluation to test the efficacy. The model is currently being disseminated through a collaborative process with regular and special educators. The impact of the program will be assessed in terms of teacher and student outcomes on a number of academic, self-concept, socialization and learning behavior measures. A total of 22 teachers are involved in the evaluation in kindergarten through third grade. Over a two year period, 637 students, 385 experimental and 252 control students will be observed and tested. The information generated from the study of the expert teachers is designed to initiate discussions between regular and special educators about strategies and their situational applications. Although the model generates useful information, it is not being imposed as a package, rather the information is viewed as a framework for initiating and evaluating strategies in the regular classroom context.

Discussion

The need to better understand the problem-situated expertise of regular class teachers can only serve to enhance collaborative communications between regular and special educators. The information generated in this investigation provides an experimental look at the expert regular class teacher and how they engage in generating solutions to problems of the mildly handicapped and at-risk student. The expert systems methodology provided both a development model for guiding the study and synthesis of information and a knowledge representation technique for identifying problem solution strategies and skill repertoires.

A major limitation of the study was that it was based on data generated from six teachers and twelve case studies. Although only six expert teachers were studied, it represents an early attempt to explore how the situational dynamics frame problem solving in a classroom. The case method of knowledge representation provides a means of studying exemplars of problems and solutions. For example, in the legal field, cases serve as exemplars for dealing with new cases and illustrate ways of thinking about a problem in terms of linking knowledge patterns to solutions. It can reveal information about how a problem is posed, how a solution is found and how information is related. The heuristic model applied in this study gave each case a central focus (Clancy, 1985). As Poplin(1987) commented, there is a need to apply new methodologies to better understand the needs of our handicapped students. The heuristic classification model (Clancy, 1985) and the expert systems development model (McFarland & Parker, 1990) provided a promising methodology for studying problem solutions and repertoires of the expert teachers. Further study and

refinements will be needed for future generalizability and comparability of case study findings.

The major findings indicated there was agreement across teachers concerning solution category subclasses. Of particular interest was the fact that these teachers shared the ***expectation*** that every student entering their classroom would learn. This expectation appears to be a result of beliefs held about their efficacy as a teacher and based upon experience in applied strategies and repertoires that have proven successful over time. Although the teachers did not apply the same sets of strategies, they applied similar classes of strategies. In particular, they viewed the classroom as a social system, where each member had roles and responsibilities. The teacher used reciprocal interactions as the vehicle for communicating the importance of the roles and responsibilities using both teacher and students as models. Through the classroom group the teacher would strategically build a sense of competence in all students as reflected in questioning strategies, risk taking and classroom participation. Fundamental these classrooms was that each learner comes with a different knowledge base to be respected. Making mistakes and taking risks are viewed as opportunities to learn. Also these teachers made opportunities to build home-school connections which they believed were fundamental to student success.

Study of these teachers did demonstrate consistency in the belief that knowledge cannot be simply "transmitted" from teacher to student. Learning involves collaboration between the student's current understanding of an idea or concept and new information. These teachers actively engaged in probing student understanding in terms of Vygotsky's (1962) zone of proximal development. The teachers elicited student responses in order to extend or elaborate upon what the learner currently understands to strategically guide the student to go beyond. Reciprocal interactions are a critical feature of these classrooms. Therefore, these classrooms could be characterized as providing a balance between teacher-student dialogue. There was also balance in strategic questioning that tapped into student understanding of information but also how that information was generated. These teachers pursued elaborations from the students as a means of shared reflection about processes used to think about information. By making these processes explicit, the teachers felt that all students in their classroom were more likely to become familiar with effective strategies that empowered them to accomplish learning tasks.

Collaborations between special and regular educators will need to consider the classroom as a social system in terms of generating solutions to the problems faced by teachers and students. This suggests that a specific intervention for a problem cannot be recommended in isolation. It must consider the dynamics of the regular classroom and consider what resources can be applied in generating solutions. For example, rather than developing a "micro" solution, collaboration between teachers may require examining classroom strategies and repertoires at the "macro" level. In other words, the successful integration of mildly handicapped and at-risk students will require reflection about current group focused strategies and repertoires and how they impact student progress. The training prototype in this study has generated sets of strategies and skill repertoires that have proven successful by expert teachers. Taking a problem-centered approach, special and regular educators may wish to apply sets of strategies using the expertise available in their schools and build a knowledge base relevant to their own contextual setting.

One of the major barriers to effective consultative collaboration relates to the implied source of expertise as being directed from special education to the regular classroom (Graden et al., 1985; Johnson, Pugach & Hammitte, 1988). Yet there is continuing emphasis that collaborative consultative should be based on reciprocal interactions (Idol et al., 1986). In order to better understand the regular classroom settings we must provide a clearer understanding about how problems are addressed by expert teachers. This study represents

an attempt to represent that knowledge base in a form that can be communicated for collaborative problem solving. The expert training system methodology proposed in this study meets the basic requirement of providing a preliminary training materials prototype that is contextually relevant and conceptually acceptable to regular educators. The result has been the development of a prototype that is derived from the knowledge and actions of expert regular educators and implemented in a working environment that seeks constructivist changes and peer support for collaboration.

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